

ZEW policybrief

Irene Bertschek (ZEW) and Wolfgang Briglauer (ZEW)

How the Digital Transformation of the Economy Can Succeed

The digital transformation is one of the greatest challenges of our time. High-speed internet, mobile devices, intelligent software algorithms and the storage and processing of enormous quantities of data are changing the economy as well as society. With it come opportunities such as the development of new products and services and new ways to increase productivity. But we can take advantage of these opportunities only if we actively find creative strategies for coming to grips with digitalisation in all its complex dimensions. The new German government, in its coalition agreement, has identified a number of ambitious digitalisation objectives that will affect large swaths of society, including the ministries themselves.¹ From an economic perspective, the three most important aspects of the plan are: the continued expansion of modern broadband infrastructures, the support of medium-sized businesses with the digitalisation process and the strengthening of digital skills. In all three areas, Germany has some catching up to do.

Three central aspects
of successful
digitalisation



MAIN FINDINGS //

- ▶ Rural areas have insufficient levels of high-speed broadband connectivity.
- ▶ More federal funding must be made available for expanding modern broadband infrastructure. Moreover, Germany must simplify the process of applying for subsidies in areas earmarked for development (where many rural communities are located).
- ▶ To put gigabit networking in place throughout Germany, strong incentives are needed for telecommunication companies such as cost-saving measures and fewer sector-specific regulations. At the same time, policies should be in place that help avoid overcapacity by incentivising consumers.
- ▶ Compared with large corporations, medium-sized companies have underused digitalisation's potential for increasing productivity and innovation.
- ▶ The federal government must make companies aware of the opportunities that come with digitalisation and provide consultation with the development of concrete implementation strategies.
- ▶ Financial assistance for small- and medium-sized companies should be simple to access and help businesses train personnel.

¹ The text of the 2018 coalition agreement is available at (in German only): https://www.bundesregierung.de/Content/DE/_Anlagen/2018/03/2018-03-14-koalitionsvertrag.pdf;jsessionid=5AAE136B56D2B4C61E378B4D06071E96.s6t2?__blob=publicationFile&v=2

THE INFRASTRUCTURAL REQUIREMENT: HIGH-SPEED INTERNET FOR EVERYONE

Ambitious expansion targets in the EU and in Germany

If companies are to develop new applications in information and communication technologies (ICT), a nationwide high-performance infrastructure of fixed and wireless broadband is a must. The 2010 Digital Agenda for Europe (DAE) identifies two crucial indicators for broadband infrastructure: the number of broadband connections offered by network operators and demand for the available connections (European Commission, 2010). These indicators figure in the DAE's EU expansion targets for fibre-optic networks and services. In the wake of these targets, the majority of EU Member States implemented national broadband plans, usually including some kind of public subsidy programme. For instance, the current broadband target in Germany (Digital Agenda 2014–2017) calls for nationwide high-speed internet connectivity (at least 50 Mbit/s) by the end of 2018.² The Digital Strategy 2025 programme released by the previous German government and the coalition agreement of the current government both hold out the prospect of creating a gigabit society going well beyond these targets.³

Despite these ambitious targets, the situation on the ground in the EU has not improved as rapidly as hoped. In fact, most Member States will have to act soon if they want to meet their broadband targets, especially with regard to countryside connectivity. Take Germany, for instance. Though its stats are above the EU average, there is considerable discrepancy between connectivity in urban and rural areas, even if one takes into consideration fixed broadband roll-outs (fibre to the x, FTTX) that use entire full optic infrastructures and those that use only partial solutions (Figure 1). Only about 50% of rural areas in Germany have any form of fibre-optic connectivity, which means that complete connectivity is unlikely to come anytime soon. The shortage in rural areas is even greater when considering full fibre optic scenarios, which include fibre optic lines running to the building (FTTB), to the home (FFTH) or directly to in-house routers and devices. In some places, only FTTH/FTTB expansions are considered gigabit infrastructures. In this regard, Germany lags behind much of Europe (Figure 2). This is mainly owing to Germany's first-generation broadband infrastructure, which is based mainly on copper wires, DSL technology and the coaxial cable infrastructure of cable network providers. Future FTTH/FTTB investment would cannibalise revenues from the existing broadband infrastructure, creating significant opportunity costs for new infrastructure investment. The UK and Austria face similar situations (Bertschek et al., 2016). Countries that want to push FTTH/FTTB networks must introduce strong investment incentives for telecommunication companies by introducing cost-saving measures and reducing regulatory intensity (Briglauer et al., 2018). They must also provide sufficient incentive to broadband consumers on the demand side, who are typically confronted with high switching costs because they are largely content with the quality and price of first generation broadband services. If few consumers decide to use FTTH/FTTB-based services, telecommunication companies will be left with costly levels of overcapacity.⁴

FTTH/FTTB lags behind

Shortage of broadband in rural areas

A recent survey conducted by ZEW and Kantar TNS found that German businesses believe broadband expansion to be the most urgent priority for successful digitalisation, with 86% of companies calling more high-speed internet infrastructure (Graumann et al., 2017). The reality, however, is that telecommunications companies are disinclined to invest in rural areas because of the high costs and low density, which cuts profitability. To handle this problem, Germany introduced public funding models several years ago, and this remains the best policy option (WIK-Consult, 2017; Gerpott, 2017). Government subsidies for the expansion of fibre-optic networks are justified given their positive externalities, such as their cost-sinking effects for other sectors. They also play an

² The text of the Digital Agenda 2014–2017 is available at: <https://ec.europa.eu/digital-single-market/en/country-information-germany>

³ The text of the Digitale Strategie 2025 is available at (in German only): https://www.bmwi.de/Redaktion/DE/Publikationen/Digitale-Welt/digitale-strategie-2025.pdf?__blob=publicationFile&v=8

⁴ Both the German Monopolies Commission (2017, 80–82) and a recent empirical study by Briglauer and Cambini (2018) stressed the necessity of complementary assistance measures for broadband consumers.

FIGURE 1:
AVAILABILITY (% OF HOUSEHOLDS) OF FTTX BROADBAND INFRASTRUCTURES
IN THE EU MEMBER STATES, TOTAL AND RURAL

(JUNE 2016, SOURCE: EUROPEAN COMMISSION, 2017A)

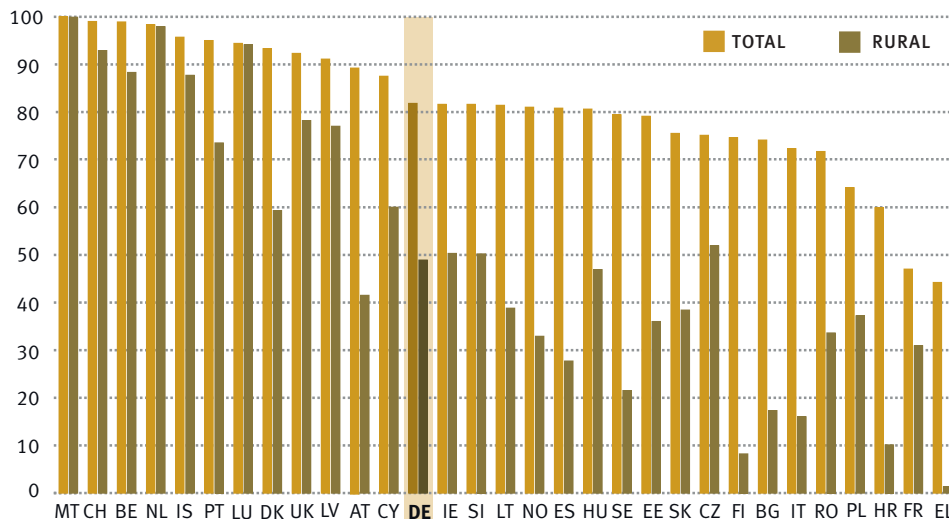
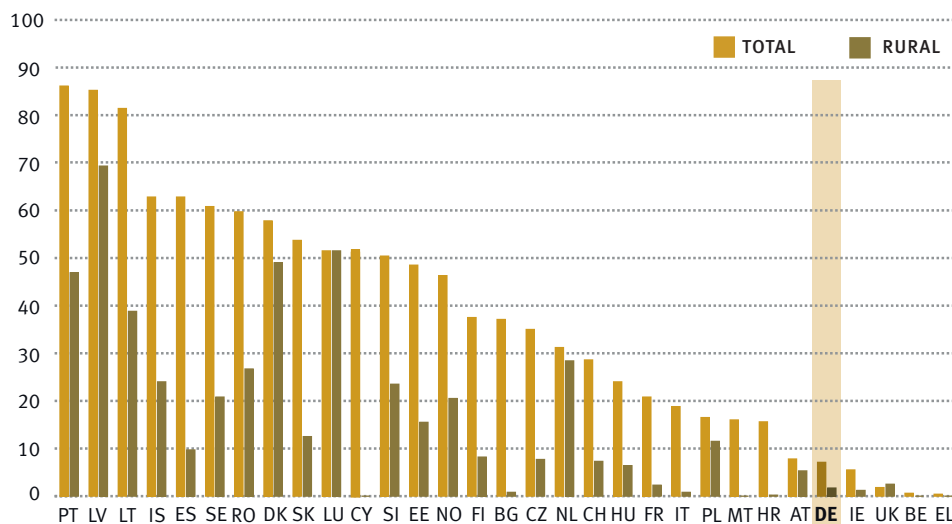


FIGURE 2:
AVAILABILITY (% OF HOUSEHOLDS) OF FTTH/FTTB BROADBAND INFRASTRUCTURES
IN THE EU MEMBER STATES, TOTAL AND RURAL

(JUNE 2016, SOURCE: EUROPEAN COMMISSION, 2017A)



essential role in preventing the creation of a digital divide and its consequences, which includes further population decline in rural areas. In fact, they can help economically depressed areas catch up with cities. Most industrial nations have funding programmes for broadband in place, which suggests that there’s little controversy surrounding their use. What has raised controversy, however, is which funding model (“profitability gap model” vs “operator model”) and which technology (e.g. FTTH/FTTB vs. FTTX) should be favoured politically at the regional and national levels.⁵ One particular challenge is how best to integrate mobile networks, especially the next-generation 5G system, into a high-performance digital infrastructure. The 5G network, which will be built

⁵ For more, see ifo Schnelldienst 20/2016, “Wie viel ist genug? Breitbandausbau in Deutschland”, 03–28, and ifo Schnelldienst 7/2018, “Ausbau der digitalen Infrastruktur bis 2025: Welche Wege führen in die ‘Gigabit-Gesellschaft?’”, 03–21.

starting in 2020, represents an entirely new technology, one that promises to flow seamlessly into fixed and wireless networks built around a common fibre-optic infrastructure. In the future, wireless building connectivity may represent an alternative solution for some consumers. Funding measures and existing (4G/LTE) mobile networks can, on account of their cost benefits, help bring coverage to rural areas and valuable contributions to rural applications such as the digitalisation of agriculture. The same applies to the instalment of broadband connections in low-density commercial zones, which will boost productivity and employment. As for existing funding measures at Germany's state and federal levels, the past few years have shown that a simplification of the complicated admission procedures is both necessary and perhaps as important as the funding programmes. At the same, the institutional structures of the funding models should be evaluated for effectivity and efficiency (Briglauer et al., 2016).

POTENTIAL FOR INNOVATION AND PRODUCTIVITY

**Digitalised companies
better equipped for
economic crises**

Digitalisation has many facets: broadband infrastructure, digital technologies such as notebooks, smartphones, and corporate software, as well as modern applications like big data, mobile apps and artificial intelligence. As so-called general purpose technologies, digital technologies can help companies to become more innovative and productive. For example, highly digitalised companies fared better during the 2008 and 2009 crisis than their less digitalised counterparts. The productivity and growth of the former barely declined, while those of the latter dropped off considerably. Highly digitalised companies are also more successful at putting innovations into practice and streamlining processes, thereby cutting costs (Bertschek et al., 2017).

Looking at individual digital applications, it shows that big data analytics, for instance, contain great potential for innovation in individual applications. Companies that systematically assess large quantities of data are more likely to develop new products and services or improve existing ones. And they can generate greater revenue from new products and services (Niebel et al., 2017). Social media such as Facebook or Twitter are examples of data sources that have gained much importance in recent years. Companies that actively ask for feedback from social network users benefit in the form of improvement to products and services. In particular, it is the negative comments that play the most significant role for companies' innovation success (Bertschek und Kesler, 2017). Making use of data should go hand in hand with handling these data responsibly. In 2016, the EU passed the General Data Protection Regulation (GDPR) to ensure data privacy and transparency and secure unhindered data flows. Yet by the end of 2017, only around 50% of German companies in ICT, media, and knowledge services had prepared themselves for the implementation of the GDPR in May of 2018. 12.5% had never even heard of it (ZEW 2018).

**Mobile and flexible work
is more productive work**

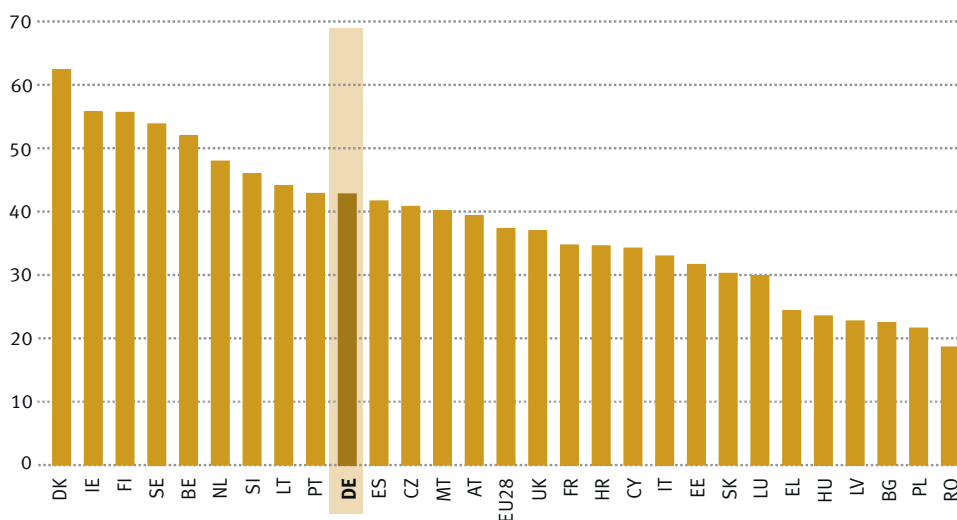
The digital transformation enables mobility. Employees can now work from home or while traveling by using laptops and other mobile devices to access email, network drives, company software, in-house wiki pages, and other resources. Between 2011 and 2015, the number of employees receiving mobile devices almost doubled, increasing from 12% to 23% (ZEW, 2015). The larger the share of employees who have been assigned mobile devices, the more productive a company becomes (Bertschek and Niebel, 2016). Technological mobility offers employees more flexibility in regards to how and where they work through working from home or trust-based work time. Service sector companies that combine mobile technologies with trust-based work time record a significantly higher productivity (Viète and Erdsiek, 2018).

THE DIGITAL TRANSFORMATION OF THE GERMAN ECONOMY

In view of the multitude of opportunities that digitalisation opens for innovation and productivity, one would expect a high penetration of digital technologies in the German business sector. But according to the Digital Economy and Society Index (DESI), Germany ranks 10th among EU-28 countries when it comes to the digitalisation of businesses and e-commerce technology (Figure 3). A closer look at the individual indicators shows that Germany ranks 1st with regard to the percentage of enterprises that support electronic information sharing and ranks 5th in the number of SMEs selling online (European Commission, 2017b). By contrast, Germany ranks 21st in cloud computing and 20th in e-commerce turnover. German enterprises also appear slow to adopt new applications. In 2017, for instance, a measly 19% of companies in the German business sector employed big data analytics, and 6% said that they were planning to use them in the near future. Just over 2% of enterprises deploy artificial intelligence applications, while 3% intend to use them soon (Graumann et al., 2017).

**German businesses
above average in
European comparison**

FIGURE 3:
INTEGRATION OF DIGITAL TECHNOLOGY IN BUSINESSES IN EU-28 MEMBER STATES,
DIGITAL ECONOMY AND SOCIETY INDICATOR
(AS OF 2017, SOURCE: EUROPEAN COMMISSION, 2017B)⁶



According to the Digital Economy Index 2017, Germany's medium-sized companies (i.e. those with between 10 and 249 employees) are on average less digitalised than its large ones (i.e. those with 250 and more employees). Digitalisation has a "major part" in the strategic focus of 45% of large companies and of only 30% of smaller enterprises. The level of digitalisation varies from branch to branch. The ICT sector shows the highest digitalisation, followed by knowledge-intensive service providers and other areas of the service sector. The manufacturing sectors, where more work is performed manually, ranks in middle of the pack, while health care services are least digitalised (Graumann et al., 2017).

**Medium-sized
businesses behind the
digitalisation curve**

⁶ https://digital-agenda-data.eu/charts/desi-components#chart={%22indicator%22:%22DESL4JDT%22,%22breakdowngroup%22:%22DESL4JDT%22,%22unit-measure%22:%22pc_DESL4JDT%22,%22time-period%22:%222017%22}, retrieved on 29.03.2018.

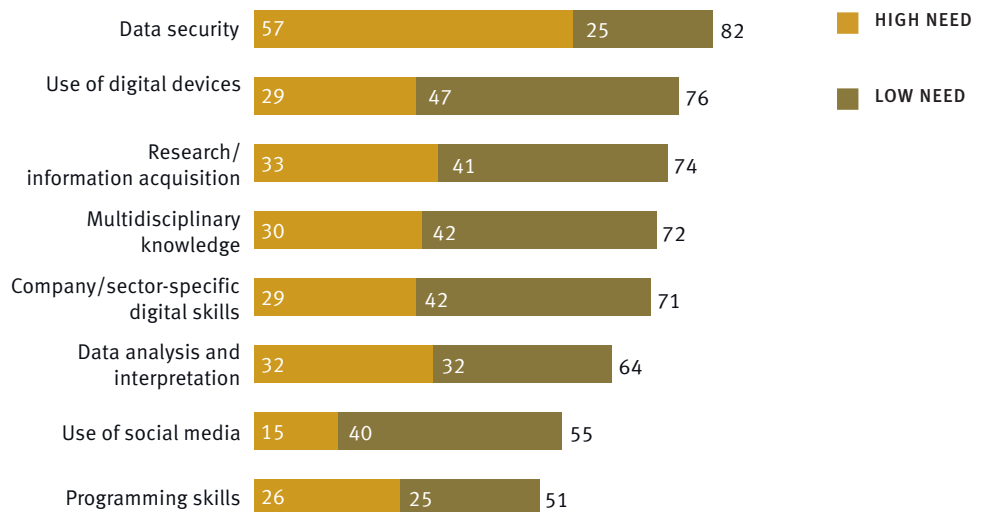
Main obstacles to digitalisation

The amount of time and organisational effort required for digitalisation is, next to slow internet speeds, the main obstacle impeding its adoption. Around two-thirds of companies in Germany see another hurdle in the lack of digital skills on the part of its employees. Accordingly, almost the same amount regard further training opportunities as “very important” or “important”, particularly in the areas of data security, digital devices, information research, and multidisciplinary knowledge (Figure 4) (Graumann et al., 2016).

**FIGURE 4:
NEED FOR DIGITAL SKILLS TRAINING**

(SOURCE: GRAUMANN ET AL., 2016)

SHARE OF ENTERPRISES THAT REPORT A HIGH OR LOW NEED FOR FURTHER TRAINING (%)



Government efforts to support digitalisation in the business sector should include informational campaigns to make companies aware of the possibilities and opportunities provided by digital technology. The government needs to promote and advise on the development of concrete digital implementation strategies. Not only must there be funding available for this work; the application procedure needs to be made easier so that smaller companies will be more inclined to take advantage of government aid. Finally, it is essential that companies and their employees receive help in acquiring the skills they will need for increased digitalisation.

REFERENCES

- Bertschek, I. and R. Kesler (2017), Let the User Speak: Is Feedback on Facebook a Source of Firms' Innovation?, ZEW Discussion Paper No. 17-015, Mannheim.
- Bertschek, I., Polder, M. and P. Schulte (2017), ICT and Resilience in Times of Crisis: Evidence from Cross-Country Micro Moments Data, ZEW Discussion Paper No. 17-030, Mannheim.
- Bertschek, I. and T. Niebel (2016), Mobile and More Productive? Firm-Level Evidence on the Productivity Effects of Mobile Internet Use, *Telecommunications Policy* 40(9), 888–898.
- Bertschek, I., Briglauer, W., Hüscherlath, K., Kauf, B. and T. Niebel (2015), The Economic Impacts of Broadband Internet: A Survey, *Review of Network Economics* 14(4), 201–227.
- Briglauer, W., Holzleitner, C. and I. Vogelsang (2016), The Need For More Efficient Public Funding of New Communications Infrastructure in EU Member States, *Information Economics and Policy* 36, 26–35.
- Briglauer, W., Cambini, C. and M. Grajek (2018), Speeding Up the Internet: Regulation and Investment in the European Fiber Optic Infrastructure, *International Journal of Industrial Organization*, forthcoming.
- Briglauer, W. and C. Cambini (2018), Does Regulation of Basic Broadband Networks Affect the Adoption of New Fiber-Based Broadband Services?, *Industrial and Corporate Change*, forthcoming.
- European Commission (2010), Eine digitale Agenda für Europa, KOM(2010) 245 final version, Brussels.
- European Commission (2017a), Broadband Coverage in Europe 2016: Mapping Progress Towards the Coverage Objectives of the Digital Agenda, http://ec.europa.eu/newsroom/document.cfm?doc_id=47090.
- European Commission (2017b), Europe's Digital Progress Report (EDPR) 2017 Country Profile Germany, <https://ec.europa.eu/digital-single-market/en/news/europesdigital-progress-report-2017>.
- German Monopolies Commission (2017), Telekommunikation 2017: Auf Wettbewerb bauen!, Sondergutachten 78, Bonn.
- Gerpott, T. J. (2017), Breitbandsubventionen des Bundes 2015 bis 2017 – eine Analyse der Förderzusagen, *ifo Schnelldienst* 20(70), 16–22.
- Graumann, S., I. Bertschek, T. Weber, M. Ebert, M. Weinzierl, J. Ohnemus, C. Rammer, T. Niebel, P. Schulte, J. Bersch (2017), Monitoring-Report Wirtschaft DIGITAL 2017 Federal Ministry for Economic Affairs and Energy, Berlin.
- Graumann, S., Bertschek, I., Weber, T., Ebert, M., Ettner, K., Speich, A., Weinzierl, M., Ohnemus, J., Niebel, T., Rammer, C., Rasel, F and Schulte, P. (2016), Monitoring-Report Wirtschaft DIGITAL 2016, Federal Ministry for Economic Affairs and Energy, Berlin.
- Niebel, T., Rasel, F. and S. Viète (2017), BIG Data – BIG Gains? Empirical Evidence on the Link Between Big Data Analytics and Innovation, ZEW Discussion Paper No. 17-053, Mannheim.
- Viète, S. and D. Erdsiek (2018), Trust-Based Work Time and the Productivity Effects of Mobile Information Technologies in the Workplace, ZEW Discussion Paper No. 18-013, Mannheim.
- WIK-Consult (2017), Ansätze zur Glasfaser-Erschließung unterversorgter Gebiete, study for the DIHK, http://www.wik.org/fileadmin/Studien/2017/2017_DIHK_Studie.pdf.
- ZEW (2018), Branchenreport Informationswirtschaft, 1. Quartal, Centre for European Economic Research, Mannheim.
- ZEW (2015), IKT-Report: Industrie 4.0 – Digitale (R)Evolution der Wirtschaft, Centre for European Economic Research, Mannheim.



FURTHER INFORMATION //

Prof. Dr. Irene Bertschek

Centre for European Economic Research (ZEW), Mannheim

Dr. Wolfgang Briglauer

Centre for European Economic Research (ZEW), Mannheim

Authors

Prof. Dr. Irene Bertschek

Head of the ZEW Research Department “Digital Economy”

E-mail: irene.bertschek@zew.de

Phone: +49 (0)621-1235-178

Contact



Zentrum für Europäische
Wirtschaftsforschung GmbH
Centre for European
Economic Research

ZEW policy brief series

Publisher: Centre for European Economic Research (ZEW) Mannheim

L 7, 1, 68161 Mannheim · P.O. Box 10 34 43, 68034 Mannheim · Germany · Internet: www.zew.de, www.zew.eu

President: Prof. Achim Wambach, PhD · Director of Business and Administration: Thomas Kohl

Editorial responsibility: Prof. Achim Wambach, PhD

Quotes from the text: Sections of the text may be quoted in the original language without explicit permission provided that the source is acknowledged.

© Zentrum für Europäische Wirtschaftsforschung GmbH (ZEW), Mannheim, 2018 · Member of the Leibniz Association